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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/940,825	08/27/2001	Ramakrishna Kakarala	10010667-1	6666

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AGILENT TECHNOLOGIES, INC.
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EXAMINER	
WILSON, JACQUELINE B	

ART UNIT	PAPER NUMBER
2612	

DATE MAILED: 07/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/940,825	KAKARALA ET AL.	
	Examiner	Art Unit	
	Jacqueline Wilson	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,6,7,15,19,20,23 and 29* is/are rejected.

7)☒ Claim(s) *3-5,8-14,16-18,21,22,24-28 and 30-33* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *05/09/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 03/09/05 have been fully considered but they are not persuasive.

Regarding Claim 6, the applicant argues that the prior art fails to teach or suggest determining a "first degree of change" from "a set of first color values" and a "second degree of change" from "a set of second color values". The examiner disagrees. Wang teaches a continuity measure C(i,j) is determined for each pixel location (wherein each measure has a row and a column component (i,j)). In order to determine the interpolation direction D(i,j), a decision is made regarding interpolation in the horizontal or vertical direction. The interpolation direction D(i,j) is also taught to represent more than two values to indicate a selection of interpolation direction among more than two directions (see col. 7, lines 45- col. 8, line 23). Once the direction is determined, an appropriate interpolation direction is performed. This indicates comparing the row and column components of the pixels to determine a selected interpolation orientation (see also figs. 4F and 4E). Since Wang teaches that interpolation directions are performed using green, red and blue values (col. 7, lines 25-35), the examiner believes Wang determines for *a given one* of the first color values associated with *a given one* of the pixel locations a first degree of change using the set of first color values and a second degree of change using the set of second color values.

The applicant further argues that the prior art fails to disclose "a first edge-orientation" and "a second edge-orientation" in which both includes "a row component" and "a column component" as recited in Claim 1. The examiner disagrees. As mentioned above, each value has a row component and a column component (as indicated by the location of the pixel (i,j)).

Therefore, the rejections are maintained.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 6, 7, 15, 19, 20, 23 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang (US 6,781,626).

Regarding Claim 1, Wang teaches determining, for the pixel, a first edge-orientation of a first color and a second edge-orientation of a second color (col. 7, lines 18-30), the first and second edge-orientations each having a row component and a column component (i,j). Wang further teaches determining an interpolation direction D(i, j) for pixel locations. In order to determine whether the pixel is in the horizontal or

vertical direction, the local intensity gradient at the location (i, j) and a continuity bias representative of intensity is determined. Wang further states that the local intensity gradient may determine the interpolation direction unless the continuity trend in the neighborhood about the pixel location (i, j) suggests otherwise (col. 8, lines 12-23). This teaches that both the local intensity gradient and the continuity bias representative must both indicate positive results for a specific interpolation direction. This is interpreted as providing respective interpolation votes associated with the first-edge orientation and the second edge-orientation to determine a selected interpolation orientation, such that the respective interpolation votes being either a first interpolation orientation (horizontal) or a second interpolation orientation (vertical). The limitation of the selected interpolation orientation being based on the number of the interpolation votes for the first interpolation orientation and the second interpolation orientation is interpreted as both the local intensity gradient (being one vote) and the continuity bias representative (another vote) both agreeing that the pixel is in same interpolation orientation.

Regarding Claim 6, Wang teaches receiving a set of first color values (red or blue also referred to as chrominance) and a set of second color values (green also referred to al luminance; col. 7, lines 25-34), determining for a given one of the first color values associated with a given one of the pixel locations a first degree of change using the set of first color values and a second degree of change using the set of second color values (a continuity measure C(i,j) is determined at each pixel location for green, red and blue values for determining the degree of continuity in the horizontal and vertical directions; col. 7, lines 45+), the first and second degrees of change each having a row component

and a column component (i,j). Wang further teaches comparing the row component to the column component for both the first and second degrees of change to determine a selected interpolation orientation (col. 8, lines 12+).

Regarding Claim 7, Wang teaches interpolating the missing second color value associated with the given pixel location using the selected interpolation orientation (see figure 7, steps 908-924).

Claim 15 is analyzed and discussed with respect to Claim 6. (See rejection of Claim 6 above.)

Claim 19 is analyzed and discussed with respect to Claim 6. (See rejection of Claim 6 above.)

Claim 20 is analyzed and discussed with respect to Claim 7. (See rejection of Claim 7 above.)

Claim 23 is analyzed and discussed with respect to Claim 6. The set of third color values are red or blue in which processing is performed on the third set the same as with the first and second sets. (See rejection of Claim 6 above.)

Claim 29 is analyzed and discussed with respect to Claim 15. (See rejection of Claim 15 above.)

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wang in view of Shinohara et al article "Color Image Analysis in a Vector Field".

Regarding Claim 2, Wang fails to specifically teach the first and second-edge orientations are first and second gradients, respectively, the first and second gradients forming a Jacobian of the pixel. However the Shinohara et al article teaches using the Jacobian matrix in edge detection for determining vector gradient magnitude (see abstract). Shinohara et al further teaches that by using the Jacobian matrix, edges are more accurate and finer than the edges obtained by other methods. Using Jacobian matrix is advantageous in the system of Wang for creating defined edges in which interpolation orientation can be determined. Therefore, it would have been obvious to one having ordinary skill in the art to have a first and second gradients forming a Jacobian of the pixel for the purpose of creating accurate edge orientation.

Allowable Subject Matter

6. Claims 3-5, 8-14,16-18, 21-22, 24-28, and 30-33 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding Claim 3, the prior art neither teaches nor fairly suggests a method for determining whether a pixel lies on an edge of a digital image, said method comprising: determining, for said pixel, a first edge-orientation of a first color and a second edge-orientation of a second color; and providing respective interpolation votes associated with said first edge-orientation and said second edge-orientation to determine a selected interpolation orientation, said respective interpolation votes being either a first interpolation orientation or a second interpolation orientation, said selected interpolation orientation being based on the number of said interpolation votes for said first interpolation orientation and said second interpolation orientation, wherein said first and second edge-orientations are first and second gradients, respectively, said first and second gradients forming a Jacobian of said pixel, **wherein said first interpolation orientation is a horizontal interpolation and said second interpolation orientation is a vertical interpolation, and wherein said step of providing further comprises: setting a first one of said interpolation votes associated with said first gradient, said first interpolation vote being set as said horizontal interpolation when the absolute value of a row component of said first gradient is lower than the absolute value of .alpha. column component of said first gradient, said first**

interpolation vote being set as said vertical interpolation when the absolute value of said column component of said first gradient is lower than the absolute value of said row component of said first gradient; setting a second one of said interpolation votes associated with said second gradient, said second interpolation vote being set as said horizontal interpolation when the absolute value of .alpha. row component of said second gradient is lower than the absolute value of a column component of said second gradient, said second interpolation vote being set as said vertical interpolation when the absolute value of said column component of said second gradient is lower than the absolute value of said row component of said second gradient; and selecting either said horizontal interpolation, said vertical interpolation or a combination of said vertical interpolation and said horizontal interpolation for said selected interpolation orientation based on said steps of setting.

Regarding Claim 8, the prior art neither teaches nor fairly suggests a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values and a set of said second color values; determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation, interpolating a missing second color

value associated with said given pixel location using said selected interpolation orientation, and further comprising **interpolating said missing second color value by applying a linear prediction function that uses said first color values and said second color values**.

Regarding Claim 10, the prior art neither teaches nor fairly suggests a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values and a set of said second color values; determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation, interpolating a missing second color value associated with said given pixel location using said selected interpolation orientation, and further comprising **determining a difference value by subtracting said interpolated missing second color value from said given first color value; and interpolating a missing first color value using at least said difference value, said missing first color value being associated with one of said pixel locations that did not produce said first color value**.

Regarding Claim 11, the prior art neither teaches nor fairly suggests a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values and a set of said second color values;

determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation, and wherein said first and second degrees of change are first and second gradients, respectively, said first and second gradients forming a Jacobian of said given first color value, and **wherein said step of comparing further comprises: supplying, by each of said first and second gradients, a respective interpolation vote, said interpolation vote being either a first interpolation orientation or a second interpolation orientation, said selected interpolation orientation being based on the number of said interpolation votes for said first interpolation orientation and said second interpolation orientation.**

Regarding Claim 16, the prior art neither teaches nor fairly suggests a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values and a set of said second color values; determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation, wherein said first color values are

chrominance color values and said second color values are luminance color values, further comprising: **determining a first mean luminance value of .alpha. first group of said luminance color values and a second mean luminance value of .alpha. second group of said luminance color values; determining a difference percentage between said first mean luminance value and said second mean luminance value; and increasing said luminance color values of said first group by said difference percentage when said first mean luminance value is lower than said second mean luminance value.**

Regarding Claim 17, the prior art neither teaches nor fairly suggests a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values and a set of said second color values; determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation, wherein said first color values are chrominance color values and said second color values are luminance color values, further comprising: **determining a Jacobian of a given one of said luminance color values from said set of luminance color values; determining a first sum of the absolute values of the values within said Jacobian; and if said first sum is less than a predefined threshold: multiplying said given luminance color value by**

four, adding said luminance color values of four diagonally adjacent pixel locations to obtain a second sum, and dividing said second sum by eight.

Regarding Claim 18, the prior art neither teaches nor fairly suggests a method for demosaicing a digital image represented as values at pixel locations, said method comprising: receiving a set of first color values and a set of said second color values; determining for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component; comparing said row component to said column component for both said first and second degrees of change to determine a selected interpolation orientation, further comprising: **determining a Jacobian of said given first color value; determining a first sum of the absolute values of the values within said Jacobian; and if said first sum is less than a predefined threshold: multiplying said given first color value by eight, adding said first color values of eight nearest pixel locations to obtain a second sum, and dividing said second sum by sixteen.**

Claim 21 is substantially similar to Claim 8.

Regarding Claim 24, the prior art neither teaches nor fairly suggests a digital image system for demosaicing a digital image represented as values at pixel locations, said system comprising: a processor adapted to receive a set of first color values and a set of second color values, said processor being further adapted to determine for a given one of said first color values associated with a given one of said pixel locations a

first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component, said row component being compared to said column component for both said first and second degrees of change to determine a selected interpolation orientation, wherein said processor is further adapted to interpolate a missing second color value for said pixel location associated with said given pixel location using said selected interpolation orientation, wherein said processor is further adapted to receive a set of third color values, said sets of first, second and third color values each being associated with a different color, said processor further being capable of determining a third degree of change associated with said third color values, and wherein **said processor is further adapted to determine a difference value by subtracting said interpolated missing second color value from said given first color value and interpolate a missing first color value for said pixel location associated with said second or third color values using at least said difference value**.

Regarding Claim 25, the prior art neither teaches nor fairly suggests a digital image system for demosaicing a digital image represented as values at pixel locations, said system comprising: a processor adapted to receive a set of first color values and a set of second color values, said processor being further adapted to determine for a given one of said first color values associated with a given one of said pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change

each having a row component and a column component, said row component being compared to said column component for both said first and second degrees of change to determine a selected interpolation orientation, wherein said processor is further adapted to interpolate a missing second color value for said pixel location associated with said given pixel location using said selected interpolation orientation, wherein said processor is further adapted to receive a set of third color values, said sets of first, second and third color values each being associated with a different color, said processor further being capable of determining a third degree of change associated with said third color values, and wherein **said first, second and third degrees of change are first, second and third gradients, respectively, said first, second and third gradients forming a Jacobian of said given first color value, each of said first, second and third gradients supplying a respective interpolation vote, said interpolation vote being either a first interpolation orientation or a second interpolation orientation, said selected interpolation orientation being based on the number of said interpolation votes for said first interpolation orientation and said second interpolation orientation.**

Claims 30, 31, and 33 are substantially similar to Claims 16-18.

Regarding Claim 32, the prior art neither teaches nor fairly suggests a digital image system for demosaicing a digital image represented as values at pixel locations, said system comprising: a processor adapted to receive a set of first color values and a set of second color values, said processor being further adapted to determine for a given one of said first color values associated with a given one of said

pixel locations a first degree of change using said set of first color values and a second degree of change using said set of second color values, said first and second degrees of change each having a row component and a column component, said row component being compared to said column component for both said first and second degrees of change to determine a selected interpolation orientation, wherein **said processor is further adapted to determine a Laplacian of a select color value within either said set of first color values or said set of second color values and add said Laplacian multiplied by an adjustable parameter to said select color value.**

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jacqueline Wilson whose telephone number is (571) 272-7322. The examiner can normally be reached on 8:30am-5:00pm (alternate Fridays off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy Garber can be reached on (571) 272-7308. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JW
06/28/05

THAI TRAN
PRIMARY EXAMINER